ume, he will be interested in 'Principles of Animal Nutrition,' by H. P. Armsby, director of the Pennsylvania State Agricultural Experiment Station, which discusses this and related topics and summarizes a large amount of interesting information. The question is also taken up by Dr. Armsby in 'The Isodynamic Replacement of Nutrients,' SCIENCE, N. S., 18 (1903), No. 459, pp. 481–487.

Some experiments which have to do with temperature during fever with especial relation to the influence of the abnormal body condition on metabolism are summarized in Bulletin No. 45 of the Office of Experiment Stations, entitled 'A Digest of Metabolism Experiments.'

The *Jahresbericht der Tier-Chemie* contains numerous titles and abstracts of articles which deal with the question under consideration. The Department of Agriculture library contains a set of this journal, which can undoubtedly be found also in a number of other public or university libraries.

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MATHEMATICS AND METAPHYSICS.

ON reading the interesting lecture of Professor Josiah Royce on 'The Sciences of the Ideal,' and learning that all leveling and serial relations come from the same root, one is reminded of the computer of the coast survey, who decided that 8×8 is not exactly 64, but plus or minus a small quantity, according to the table of logarithms he used. If mathematics and metaphysics coalesce where shall we rest? Will our mathematicians become 'flabbier and flabbier'?

A. HALL.

October 10, 1904.

SPECIAL ARTICLES.

WHAT IS AN ELECTRIC CURRENT?*

THE question of the day which seems to appeal most strongly to the physicist is: What is taking place in a metallic conductor on the terminals of some electrical source?

* Abstract from an address on 'Present Problems in Physics,' at the Congress of Arts and Science.

Rowland's rotating disk showed that a positively charged body moving in a positive direction, and a negatively charged body moving in an opposite direction, produce the same electromagnetic effects in the surrounding field.

Rutherford's work in deflecting the electrons of a radioactive body is in entire harmony with Rowland's result. Positively charged masses of radiant matter are deflected in the opposite direction from negatively charged matter, when acted upon by a magnetic field, the masses are, of course, moving in the same direction. These charged particles of moving matter are, in effect, superposed, or perhaps juxtaposed electric currents moving in the same direction. If either the α or the β particles could be reversed in direction, then the magnetic field would deflect them in the same direction. They would then each create the same external magnetic effects. They would then represent superposed currents of opposite sign, moving or flowing in opposite directions.

All of this means that a positive current of electricity flowing in a positive direction is not a negative current of electricity flowing in a negative direction. These two currents involve the motion of masses of matter in opposite directions. Do these currents co-exist in the conducting wire? Is a direct-current dynamo pouring oppositely moving electrons into the opposite ends of the conductor? After a few thousand years of continuous use, may it become clogged and lose in part its conductive properties, acquiring perhaps meanwhile radioactive properties?

Wheatstone made a famous experiment on the discharge of a Leyden jar, which was thought very instructive in his day. But did his contemporaries really learn the lesson which that experiment teaches. The sparks at the two gaps nearest the terminals of the conductor were formed before the central spark appeared. Have we not here evidence that the positive and negative currents, moving in opposite directions, begin at the opposite terminals, and only become superposed after an appreciable time interval?

In a Geissler tube having a length of about